

1- Let set of tasks to be processed by 1 server, find the average completion time, average service time, average waiting time, using batch schedule and time sharing with slot time =10 time units .

task	1	2	3	4	5	6	7	8	9	10	11	12	13
time	25	22	12	20	2	50	30	10	2	20	40	10	5

Using batch FCFS (first come first serviced)

task	1	2	3	4	5	6	7	8	9	10	11	12	13	Av.
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5	19
Wait time	0	25	47	59	79	81	131	161	171	173	193	233	243	122.8
Compleat. time	25	47	59	79	81	131	161	171	173	193	233	243	248	141.8

You must notice that : av. Completion time=av. Wait time + av. Service time

Using time sharing,

task	1	2	3	4	5	6	7	8	9	10	11	12	13	Av.
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5	19
Wait time	0, 109, 181	10, 119, 186	20, 129	30, 131	40	42, 141, 188, 218, 238	52, 151, 198	62	72	74+ 161	84+ 171, 208 228	94	104	140.3
Compleat. time	10, 119, 186 #	20, 129, 188 #	30, 131 #	40, 141 #	42 #	52, 151, 198, 228, 248 #	62, 161, 208 #	72 #	74 #	84, 171#	94, 181, 218, 238 #	104 #	109 #	147

You must notice that : av. Completion time<av. Wait time + av. Service time

Av. Completion time > case of batch

av. Wait time > case of batch

av. Service time is the same t batch

2- For the last problem using batch system , if tasks have the next priorities, find completion time, average service time, average waiting time

task	1	2	3	4	5	6	7	8	9	10	11	12	13
priority	5	2	2	1	7	1	2	3	2	1	2	4	2
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5
Order of execut.	2	5	6	11	1	12	7	4	8	13	9	3	10

priority	5	2	2	1	7	1	2	3	2	1	2	4	2	Av.
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5	19
Order of execut.	2	5	6	11	1	12	7	4	8	13	9	3	10	
Wait time	2	47	69	158	0	178	81	37	111	228	113	27	153	92.6

Compleat. time	27	69	81	178	2	228	111	47	113	248	153	37	158	111.6
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You must notice that : av. Completion time= av. Wait time + av. Service time, as in case of batch without priority

Av. Completion time < case of batch

av. Wait time < case of batch

av. Service time is the same t batch

- 3- For the last problem using batch system , if tasks have the priorities that shortest execution task is first serviced (**SEFS**), find completion time, average service time, average waiting time

task	1	2	3	4	5	6	7	8	9	10	11	12	13
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5
Order of execut.	10	9	6	7	1	13	11	4	2	8	12	5	3

Order of execut.	10	9	6	7	1	13	11	4	2	8	12	5	3	Av.
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5	<b>19</b>
Wait time	103	81	29	41	0	198	128	9	2	61	158	19	4	<b>64</b>
Compleat. time	128	103	41	61	2	248	158	19	4	81	198	29	9	<b>83.</b>

You must notice that : av. Completion time= av. Wait time + av. Service time, as in case of batch

Av. Completion time < case of batch

av. Wait time < case of batch

av. Service time is the same t batch

- 4- Using 2 parallel processors, in batch system, find the average completion time, average service time, average waiting time

task	1	2	3	4	5	6	7	8	9	10	11	12	13
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5

task	1	2	3	4	5	6	7	8	9	10	11	12	13	Av.
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5	19
Wait time	0	0	22	25	34	36	45	75	85	86	87	106	116	55.2
Comp. S1	25			45			75	85	87		127			74.2
Compl.S2		22	34		36	86				106		116	121	

You must notice that : av. Completion time= av. Wait time + av. Service time, as in case of batch

Av. Completion time < case of batch – for 1 processor

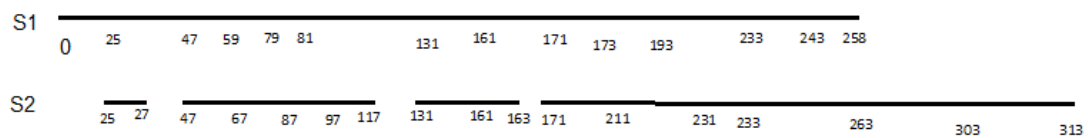
av. Wait time < case of batch – for 1 processor

av. Service time is the same for batch

5- Using 2 serial processors, find the average completion time, average service time, average waiting time

task	1	2	3	4	5	6	7	8	9	10	11	12	13
S1	25	22	12	20	2	50	30	10	2	20	40	10	15
S2	2	20	20	10	20	30	2	40	20	2	30	40	10

task	1	2	3	4	5	6	7	8	9	10	11	12	13	Av.
S1	25	22	12	20	2	50	30	10	2	20	40	10	15	19.8
S2	2	20	20	10	20	30	2	40	20	2	30	40	10	18.9
Wait s1	0	25	47	59	79	81	131	161	171	173	193	233	243	122.8
Wait s2	25	47	67	87	97	131	161	171	211	231	233	263	303	155.9
Comp. s1	25	47	59	79	81	131	161	171	173	193	233	243	258	142.6
Comp. S2	27	67	87	97	117	161	163	211	231	233	263	303	313	174.8



For server s2: idle times:  $(0-25) + (27-47) + (117-131) + (163-171)$

S1 end services after 258

You must notice that :

av. Completion time  $S_i = \text{av. Wait time } S_i + \text{av. Service time } S_i, i=1,2$

Av. Completion time = av. Completion time for server S2

av. Wait time in system = av. Waiting time for S2

6- Using 3 parallel processors, find the average completion time, average service time, average waiting time

task	1	2	3	4	5	6	7	8	9	10	11	12	13
time	25	22	12	20	2	50	30	10	2	20	40	10	5

task	1	2	3	4	5	6	7	8	9	10	11	12	13	Av.
Service time	25	22	12	20	2	50	30	10	2	20	40	10	5	19
Wait time	0	0	0	12	22	24	25	32	42	44	55	64	74	30.3
Complete S1	25						55				95			49.4
Complete S2		22			24	74							79	
Complete S3			12	32				42	44	64		74		

You must notice that :

av. Completion time for 3 servers < av. Completion time for 2 servers < av. Completion time for 1 servers

av. Wait time for 3 servers < av. Wait time for 2 servers < av. Wait time for 1 servers

7- The code 101010 10 is to be send to destination, it is received as 10101101 show how you can detect and correct error

Using even parity: the sent code even parity but the received is odd parity,  
using 4 bit -hamming code for the sent code:  $1010 * 101 * 0 ** == 101001011000$ ,  
the received code 101001101100 so location 4 is faulty , this is not correct because there are 3 errors 10101101. This hamming code can detect location of 1 error, if more than 1 error, it show an error but can' not define the location  
using CRC code, assume 101, the code is sent like: 1010101000, when received as: 1010110100, it gives remainder 100

8- Apply 2D-odd parity for code 1011101011001001 to check if an error occurred when the code is received as 1011111011000001

10111010 0  
11001001 1  
10001100 0

When received

10111110 0  
11000001 1  
10001100 0

There are errors in 1<sup>st</sup> and 2<sup>nd</sup> rows, in col. 5,6, so the faults in the shown bits,

10111110 0  
11000001 1  
10001100 0

The correct code may be 1011011011000101 or 1011101011001001 instead  
1011111011000001

9- Given the costs of transporting data (programs) from supply servers to demand servers, show the optimal volumes to be transferred to fulfill minimum cost

From	To			Supply
	1	2	3	
A	6	7	4	100
B	5	3	6	180
C	8	5	7	200
Demand	135	175	170	

**Initial solution:** using minimum cost , we fill the table like:

	1	2	3	
A	6	7	4/100	100=0
B	5/5	3/175	6	180=5=0
C	8/130	3	7/70	200=130=0
	135=130=0	175=0	170=70=0	

Cost=2480

	1	2	3	
A	6	7	4/100	100=0

<b>B</b>	5/5	3/105	6/70	180=5=0
<b>C</b>	8/130	3/70	7/	200=130=0
	135=130=0	175=0	170=70=0	

	<b>1</b>	<b>2</b>	<b>3</b>	
A	6	7	4/100	100=0
<b>B</b>	5/110	3/	6/70	180=70=0
<b>C</b>	8/25	3/175	7/	200=25=0
	135=25=0	175=0	170=70=0	

Cost= 2095

- 10- Given the costs of transporting programs from supply servers to demand servers, show the minimum cost for transferring process

	<i>1</i>	<i>2</i>	<i>3</i>	
A	6	9	7	130
B	12	3	5	70
C	4	11	11	100
<b>Demand</b>	80	110	60	

**Initial solution:** using minimum cost , we fill the table like:

	<b>1</b>	<b>2</b>	<b>3</b>	
A	6	9/40	7/60	130=30
<b>B</b>	12	3/70	5	70=0
C	4/80	11	11	100=20
	80=0	110=40=0	60=0	

No reduction, Cost= 1310

- 11- Given the costs of transporting data from supply to demand, find the minimum cost for transportation

	<b>1</b>	<b>2</b>	<b>3</b>	
A	6	8	10	150
<b>B</b>	7	11	11	175
C	4	5	12	275
	200	100	300	

**Initial solution:** using minimum cost , we fill the table like:

	<b>1</b>	<b>2</b>	<b>3</b>	
A	6	8/25	10/125	150=125=0
<b>B</b>	7	11	11/175	175=0
C	4/200	5/75	12	275=75=0
	200=0	100=25=0	300=125=0	

	<b>1</b>	<b>2</b>	<b>3</b>	
A	6/25	8/	10/125	150=125=0
<b>B</b>	7	11	11/175	175=0
C	4/175	5/100	12	275=175=0

	$200=25=0$	$100=0$	$300=125=0$	
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Cost =4525